



# The Bobbinator

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## TOOLS:

- [Sewing machine \(1\)](#)
- [cable/bolt cutter \(1\)](#)



## PARTS:

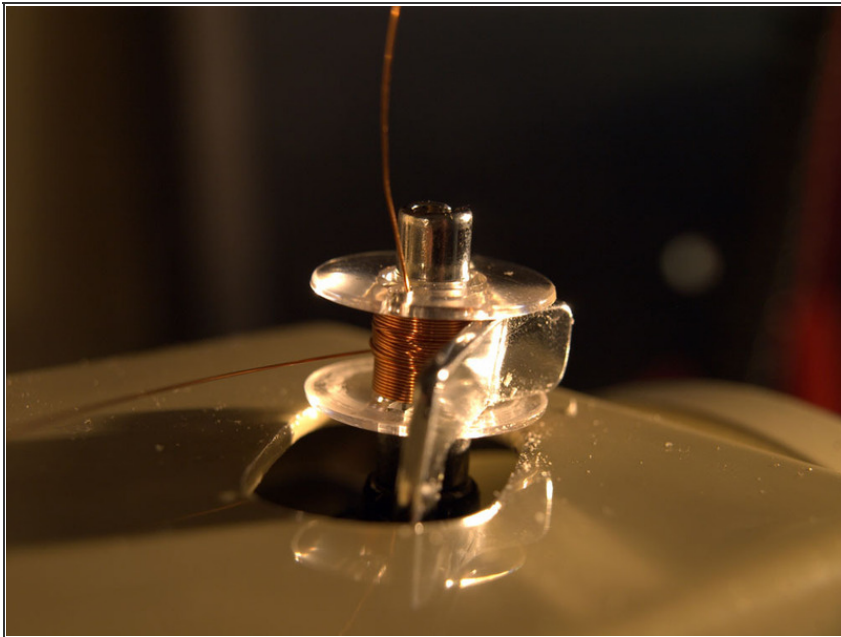
- [Bobbins \(1\)](#)  
*[for sewing machine](#)*
- [Magnets \(1\)](#)
- [Rod \(1\)](#)
- [Wire \(1\)](#)
- [PTFE tape \(1\)](#)  
*[aka Teflon plumber's tape](#)*
- [Thin plastic or laminated card \(1\)](#)
- [Epoxy glue \(1\)](#)



## SUMMARY

Linear actuators are motors that work in a straight line. They're very useful for controlling valves and levers, building robots, and retrofitting old mechanisms for digital control. The simplest form of linear actuator has only 2 positions, while more complicated actuators can be positioned just like stepper motors and servos.

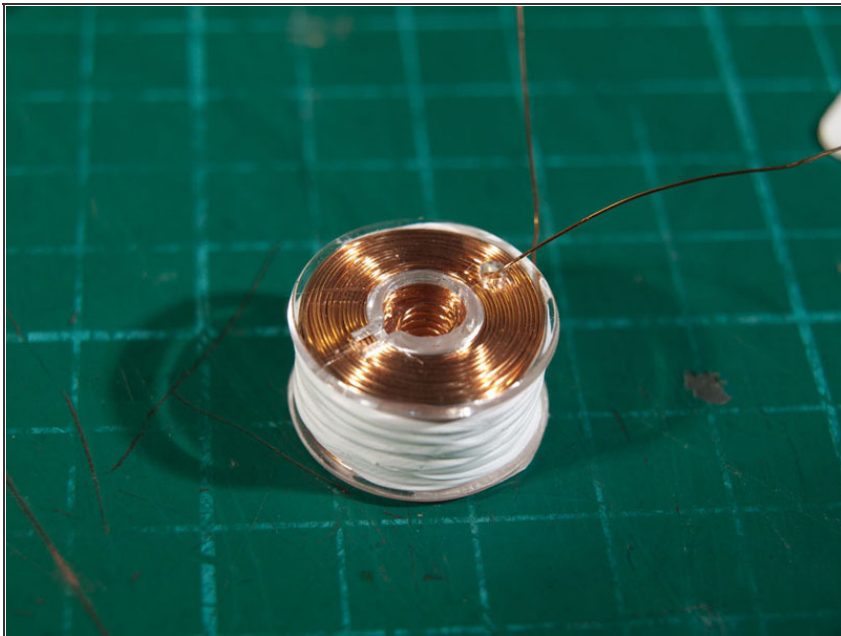
I needed 32 linear actuators for my latest project, and I was shocked to discover how much they would cost. After a little thought, I decided that I only needed simple on/off actuators, and I would try to make them myself using off-the-shelf parts.

## Step 1 — Wind the bobbin.



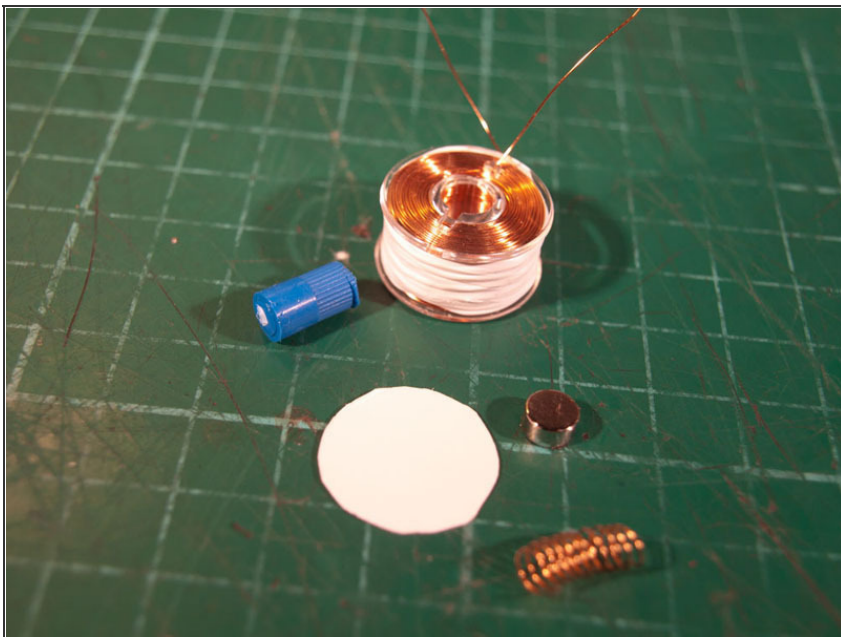
- Place an empty bobbin onto the bobbin filler on the sewing machine. Feed the end of the copper wire into the hole at the top of the bobbin. I left about 1" of wire sticking out of the top, so I could solder the coil in place later.
- Feed the wire through the thread guide nearest to the bobbin filler. Do not use the tensioning wheel or the other guides.
- Place the spool of wire somewhere that it won't snag, and run the sewing machine slowly. Watch the spool fill with copper wire, and apply gentle tension to the wire with your hand.
- Don't grab the wire tightly, or you'll cut yourself. 
- When the bobbin is full, stop the machine. Hold the wire in place on the bobbin with your thumb. Cut the wire about 1" from the side of the bobbin, and then remove the bobbin from the bobbin filler.
- Remember to keep your thumb on the side of the bobbin, or the wire will unravel. 

## Step 2 — Wrap the bobbin.



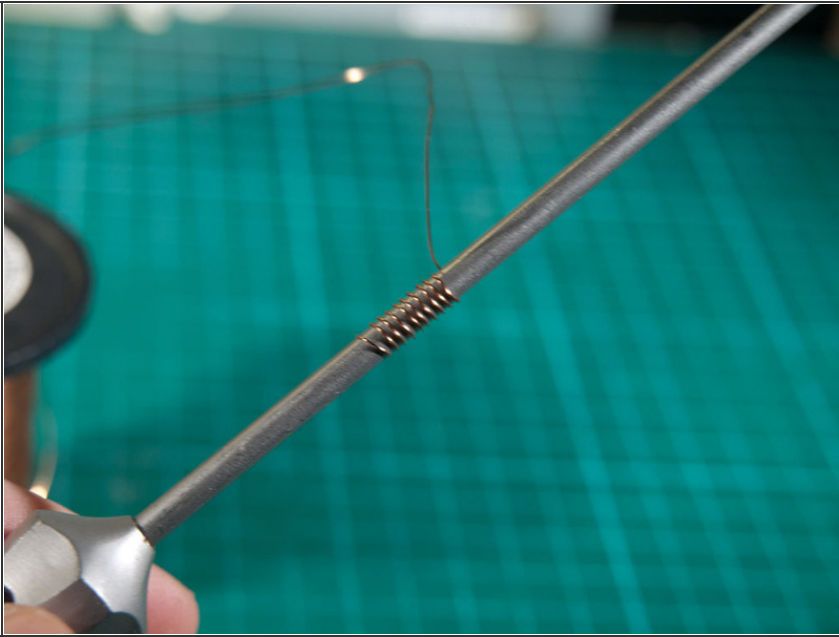
- Wrap a couple of layers of PTFE tape around the side of the bobbin. Make sure that the wire at the side of the bobbin is roughly aligned to the wire poking out of the top.

## Step 3 — Add plastic.



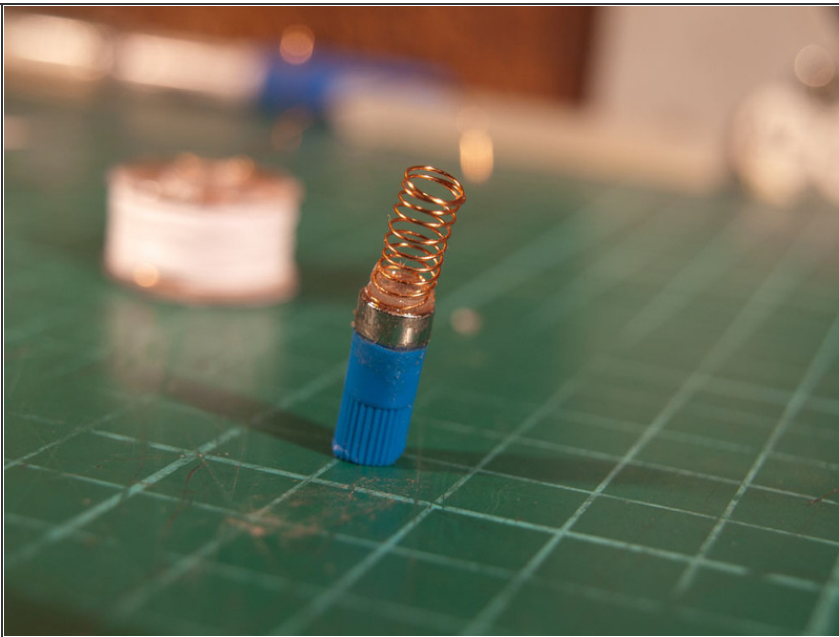
- Cut a circle of thin plastic and glue it to the bottom of the bobbin. Make sure the hole through the bobbin is blocked off on the side opposite to the wires.


### Step 4 — Add spring.



- Take a short length of the copper wire, and wind it around a thin screwdriver shaft to make a small spring. The spring should be about 4mm diameter, and about 3/4 the height of the bobbin.

### Step 5 — Add magnet.



- Glue a 6mm magnet onto the end of a length of metal or plastic rod. I needed about 1/2" of plastic rod, so I used the shaft from an old plastic potentiometer.
- Don't get too much glue around the edge of the  shaft, or it may get wedged inside the bobbin when you fit it.
- Finally, add another dab of glue to the magnet, and glue it to the spring. Fit the spring inside the bobbin center, and fix with a bit more glue.

You should now have a simple linear actuator that pulls the shaft inside the bobbin when you apply a voltage to the coil.

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You can reverse the action of the actuator by reversing the voltage, and you can reverse the action of the spring by using a thinner shaft with a second piece of thin plastic as a washer on the end of the bobbin.

You can also use multiple coils to create a longer stroke for the actuator, and position the shaft by varying the current between each of the coils. I find that each coil has a resistance of between  $8\Omega$  and  $9\Omega$ , and works well between 6V and 12V. Increasing the voltage will up the power, but will also increase the heat generated by the coil. Experiment to find the maximum voltage for a particular application, and with long duty cycles, stick a thermal fuse next to the coil for safety's sake.

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